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THE CHAMOIS.

(Abridged from 'Menageries,' Vol. I.)

[Hunting the Chamois.]

THE chamois inhabits the most inaccessible parts of the woody regions of the great mountains of Europe. Like the klipspringer of the Cape, he is remarkable for the wonderful extent and precision of his leaps. He bounds over the chasms of rocks—he springs from one projection to another with unerring certainty—he throws himself from a height of twenty or even thirty yards, upon the smallest ledge, where there is scarcely room for his feet to plant themselves. This extraordinary power of balancing the body—of instantly finding the centre of gravity,—is a peculiarity of all the goat tribe, to which the chamois is nearly allied. The ability of the eye to measure distances, with such undeviating exactness, is associated with this power of finding the centre of gravity. In the chamois these are instinctive faculties, which he possesses almost from the moment of his birth. They are not the result of training; for the young chamois has only to acquire the necessary strength to be able to imitate the feats of his more practised companions.

And yet man, by constant training, may attain an excellence in the employment of his senses very little inferior to the instinctive powers of the lower animals. The chamois hunters of the Alps are remarkable examples of what he may accomplish by courage, perseverance, and constant experiment. If man fairly bring his physical powers, and his mechanical aids, into a contest even with such surprising faculties as the chamois possesses, the triumph is his; and this triumph shows us that there are few things beyond the reach of human energy. The hunting of the chamois has been strikingly depicted in a work which unites the highest attainments of science, with an occasional display of the more common interest of picturesque description *.

The chamois hunter sets out upon his expedition of fatigue and danger generally in the night. His object is to find himself at the break of day in the most elevated pastures, where the chamois comes to feed before the flocks shall have arrived there. The chamois feeds only at morning and evening. When the hunter has nearly reached the spot where he expects to find his prey, he reconnoitres with a telescope. If he finds not the chamois, he mounts still higher; but if he discovers him, he endeavours to climb above him and to get nearer, by passing round some ravine, or gliding behind some eminence or rock. When he is near enough to distinguish the horns of the animal (which are small, round, pointed, and bent backward like a hook, as in the above cut), he rests his rifle upon a rock, and takes his aim with great coolness. He rarely misses. This rifle is often double-barrelled. If the chamois falls, he runs

* Voyages dans les Alpes, par H. B. de Saussure. Tom. ii. § 736. Genève, 1786. 4to.

to his prey, makes sure of him by cutting the ham-strings, and applies himself to consider by what way he may best regain his village. If the route is very difficult, he contents himself with skinning the chamois; but if the way is at all practicable with a load, he throws the animal over his shoulder, and bears it home to his family, undaunted by the distance he has to go, and the precipices he has to cross.

But when, as is more frequently the case, the vigilant animal perceives the hunter, he flies with the greatest swiftness into the glaciers, leaping with incredible speed over the frozen snows and pointed rocks. It is particularly difficult to approach the chamois when there are many together. While the herd graze, one of them is planted as a sentinel on the point of some rock, which commands all the avenues of their pasturage;—and when he perceives an object of alarm, he makes a sharp, hissing noise, at the sound of which all the rest run towards him, to judge for themselves of the nature of the danger. If they discover a beast of prey or a hunter, the most experienced puts himself at their head, and they bound along, one after the other, into the most inaccessible places.

It is then that the labours of the hunter commence; for then, carried away by the excitement, he knows no danger. He crosses the snows, without thinking of the precipices which they may cover; he plunges into the most dangerous passes of the mountains—he climbs up, he leaps from rock to rock, without considering how he can return. The night often finds him in the heat of the pursuit; but he does not give up for this obstacle. He considers that the chamois will stop during the darkness as well as himself, and that on the morrow he may again reach them. He passes then the night, not at the foot of a tree, nor in a cave covered with verdure, as the hunter of the plain does, but upon a naked rock, or upon a heap of rough stones, without any sort of shelter. He is alone, without fire, without light; but he takes from his bag a bit of cheese, and some of the barley-bread, which is his ordinary food—bread so hard that he is obliged to break it between two stones, or to cleave it with the axe which he always carries with him to cut steps which shall serve for his ladder up the rocks of ice. His frugal meal being soon ended, he puts a stone under his head, and is presently asleep, dreaming of the way the chamois has taken. He is awakened by the freshness of the morning air; he rises, pierced through with cold; he measures with his eyes the precipices which he must yet climb to reach the chamois; he drinks a little brandy, (of which he always carries a small provision,) throws his bag across his shoulder, and again rushes forward to encounter new dangers. These daring and persevering hunters often remain whole days in the dreariest solitudes of the glaciers of Chamouni; and during this time, their families, and, above all, their unhappy wives, feel the keenest alarm for their safety.

And yet, with the full knowledge of the dangers to be encountered, the chase of the chamois is the object of an insurmountable passion. Saussure knew a handsome young man, of the district of Chamouni, who was about to be married; and the adventurous hunter thus addressed the naturalist:—"My grandfather was killed in the chase of the chamois; my father was killed also; and I am so certain that I shall be killed myself, that I call this bag, which I always carry hunting, my winding-sheet: I am sure that I shall have no other; and yet if you were to offer to make my fortune, upon the condition that I should renounce the chase of the chamois, I should refuse your kindness." Saussure adds, that he went several journies in the Alps with this young man; that he possessed astonishing skill and strength, but that his temerity was greater than either; and that two years afterwards he met the fate which he anticipated, by his foot failing on the brink of a precipice to which he had leaped. It is the chase itself which attracts these people, more than the value of the prey; it is the alternation of hope and fear—the continual excitement—the very dangers themselves—which render the chamois hunter indifferent to all other pleasures. The same passion for hardy adventure constitutes the chief charm of the soldier's and the sailor's life; and, like all other passions, to be safe and innocent, it must be indulged in great moderation—near akin as it is to one of our most senseless and mischievous propensities, gambling.

The very few individuals who grow old in this trade bear on their countenances the traces of the life which they have led. They have a wild, and somewhat haggard and desperate air, by which they may be recognized in the midst of a crowd. Many of the superstitious peasants believe that they are sorcerers—that they have commerce with the evil spirit, and that it is he that throws them over the precipices. When the enormous glaciers and summits of Mont Blanc are beheld from the vallies, it is indeed almost miraculous that any mortal should be found hardy enough to climb them; and it is not unnatural that a simple peasantry should believe that something above human excitement had inspired these perilous undertakings. To the traveller, or to the native of the vale of Chamouni, Mont Blanc is an object of awe and astonishment; and the devotion of the instructed, and the superstition of the unenlightened, are perhaps equally attributes to the God of nature, when they thus look upon one of the grandest of natural objects—

"The dread ambassador from earth to heaven."

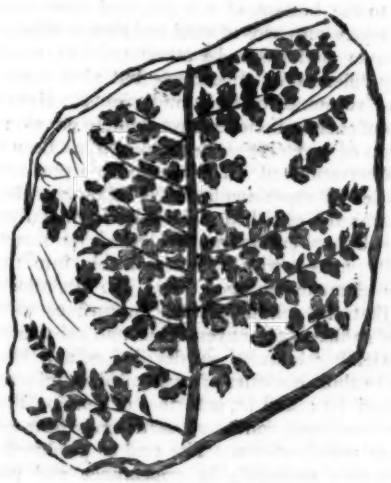
The chamois is now getting rare in Switzerland, in consequence of the inhabitants being allowed to hunt him at all seasons; but the race may be expected once more to multiply, as the old regulations for determining the periods of hunting are again introduced.

MINERAL KINGDOM.—SECTION 17.

COAL.

Origin of Coal.—If we examine a piece of this substance, particularly the fat, caking quality from Newcastle, we find it a compact, shining, stony body; but there are few fragments, even of a moderate size, in which we may not discover some parts very like charcoal, and very often with the distinct structure of wood or other vegetable matter. Such appearances are most frequently observed in the slaty coal of Staffordshire, Scotland, and other parts. Our knowledge of the nature of coal has been much advanced by an instrument new in mineral analysis, but which, in other departments of nature, has brought many hidden things to light. By an ingenious application of the microscope, Mr. Witham has exhibited a delicate cellular structure in fossil woods, which, without such aid, presents only the appearance of compact stone; and he has detected the same in coal, by subjecting extremely thin slices of it to this very highly magnifying power. His researches have been followed up by Mr. William Hutton, of Newcastle, who has thereby done much not only to elucidate the vegetable origin of coal, but to explain many chemical phenomena connected with it which were previously very little understood. Mr. Hutton states that, in all the varieties of coal found in the Newcastle coal-field, more or less of the fine, distinct, net-like structure of the original vegetable texture can always be discovered. The vegetable origin of coal is further illustrated by the vast quantities of fossil plants found in the sandstones and shales which are interstratified with the beds of coal. These are often in an extraordinary degree of preservation, for the most delicate leaves are spread out on the stone like the dried plants on the paper in the herbarium of a botanist. How perfectly

the forms are preserved the following specimen will show :—



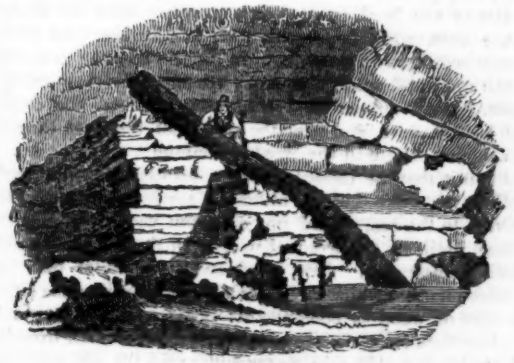
[Sphenopteris Trifolialata.]

This plant belongs to the fern tribe, and the specimen is from the shale-beds of a coal-field in Silesia, in Germany; but others, quite as distinct in form, are common in the coal-fields of this country.

About three hundred different species of plants have been discovered in the coal-measures of this and of other countries, and of these fully two-thirds have a close resemblance to ferns. Among the rest, one of the kinds most frequently found belongs to that tribe of plants which botanists call the *equisetacea*, of which the weed so common in our ditches, known by the name of horse-tails, is an example; but while the stem of these rarely exceeds the diameter of a goose-quill, the fossil equiseta are sometimes as thick as a man's arm. Other fossil coal-plants resemble large reeds and canes; and bodies which appear to be fragments of the branches and stems of palms and other trees are of frequent occurrence. It is a remarkable circumstance, that no remains either of grasses or of mosses have yet been observed in the coal-measures—plants which are not very often absent where vegetation is abundant, especially in moist situations; and the character of the whole fossil flora of the coal-fields shows, that the plants must have grown in marshy or humid ground. These terrestrial plants are never mixed with any of those which grow in the sea. It is a very striking fact, too, that they are generally of such a size as to indicate a degree of luxuriance of growth that is now known to exist only in tropical regions. "It would hardly be credited," says Professor Lindley, in his 'Fossil Flora of Great Britain,' "by persons unacquainted with the evidence upon which such facts repose, that in the most dreary and desolate regions of the present day, there once flourished groves of tropical plants of coniferæ, like the Norfolk island and Araucarian pines, of bananas, tree ferns, huge cacti, and palms; that the marshes were filled with rush-like plants fifteen or twenty feet high, and the coverts with ferns like the undergrowth of a West India island."

In the greater proportion of the fossil plants of the coal-measures there is little appearance of woody matter; stems of a foot and a half in diameter have been found with the external form perfectly preserved, but having only a coating of coaly matter of inconsiderable thickness, the interior part consisting of sandstone or clay, with now and then some more coaly matter in the centre, indicating, as it were, the pith. But trunks of trees, in which the woody texture was preserved nearly throughout the whole stem, have often been met with: they have been seen in the coal-mines of Westphalia sixty feet in length; and two remarkable instances of fossil trees in the coal-measures have occurred in Great Britain, which have been well described by Mr. Witham. In a bed of sandstone near Gosforth, about five miles north of Newcastle-upon-Tyne, a stem was found which measured seventy-two feet in length, four feet in width at its lower end, from which it tapered gradually, and was eighteen inches wide at the top. It was in a compressed state, as if flattened by great incumbent pressure, so that the above dimensions of the width are not the true diameter of the stem. The woody structure was, in this instance, only in part preserved, but in those places it was converted into a siliceous or flinty petrifaction, containing cavities lined with rock crystal; and this petrified portion was, in one place, nearly two feet in diameter. There were no roots attached to it, and no branches, but there were large knots and other places where branches appear to have been broken off. The other instance occurred in the great freestone quarries of Craigleith, near Edinburgh, from which the greater part of the New Town of that city has been built, a sandstone belonging to the coal-field of Mid Lothian, but underlying, it is believed, the regular coal-measures. It was a stem forty-seven feet long,—a large branchless trunk, in some parts very much flattened, the greatest diameter being five feet, the smallest nineteen inches. It was imbedded in the solid stone, with above a hundred feet of layers of rock above it, and lay across the strata, thus passing through several beds.

The following sketch of the appearance of the tree, as it was laid bare in the quarry, is copied from Mr. Witham's Memoir :—



[Fossil-Tree at Craigleith Quarry.]

The bark was converted into coal; but, in the interior, the woody texture was in many places perfectly preserved, as was shown by the ingenious process of Mr Witham above mentioned. It is conjectured to belong to the coniferæ or fir-tree tribe, but there are some peculiarities of structure which make that doubtful. A large portion of this stem may be seen in the Museum, and another in the Botanic Garden of the University of Edinburgh.

It is the general opinion of geologists that our beds of coal have been produced by vast quantities of plants carried down from the land and accumulated at the bottom of the sea, during a long succession of ages; the numerous alternations, amounting to many hundreds, sometimes of sandstones, shales, and beds of coal, proving a long duration of the process of deposition. The character of the vegetation indicates not only a tropical but also an insular climate; that is, the plants must have grown on islands in a very moist atmosphere, and in a heat as great or even greater than that of the West Indies. To account for the extraordinary luxuriance of the vegetation, M. Adolphe Brongniart, a living French naturalist, to whom we owe the greater part of all our most accurate information on the subject of fossil botany, has suggested that there was probably a much larger proportion of carbonic acid gas in the atmosphere of that

period than now exists; that gas being one great source of vegetable matter in the growth of plants. As any great proportion of carbonic acid gas would render the air unfit to support animal life, the absence of the remains of land quadrupeds, among such accumulations of terrestrial plants, certainly gives some countenance to the conjecture. This mode of accounting for the deposition of our coal-beds, is greatly in conformity with what must be now going forward in many parts of the earth to prepare beds of coal for future far-distant ages. Every river must carry down to the sea more or less of the trees and other plants which either fall accidentally into it, or are swept from the banks by the force or undermining action of the stream; and the accumulation of such vegetable matter at the mouths of the larger rivers must be very great. In the case of the Mississippi, for instance, vast rafts, composed of trees held together by the interlacing of smaller plants, which have been washed from the banks by the main stream and its numerous tributaries, are floated down into the Gulf of Mexico, bearing upon them a luxuriant covering of plants. The magnitude which some of these rafts attain, by accumulation, while they are temporarily arrested in their progress to the sea, is truly astonishing. An obstruction of this sort in the Atchafalaya, one of the outlets of the Mississippi in the lower part of its delta, produced a raft of this sort ten miles in length, two hundred and twenty yards wide, and eight feet deep. It rose and fell with the water during the changes of flood and drought, and, although floating, its surface was covered with a variety of living plants. In many parts of the coast, by depressions of the land, great forests growing near the shore have been sunk below the level of the sea; the trees have been thrown down, and in process of time covered with mud and sand, the waves rolling over them every tide. Such submarine forests now exist on the coast of Lincolnshire, and near the mouth of the river Parrot in Somersetshire in the Bristol Channel.

But it may be thought very naturally that trees and other vegetable bodies, although carried down by the rivers to the sea, would not sink, but would continue to float, until, by the gradual process of decay, they would totally disappear. But wood swims in water only in consequence of the air contained in its cells; the substance of wood is considerably heavier than water, and it therefore sinks as soon as the air is withdrawn from it. Very long soaking in water will expel the air, but this will take place more speedily when great pressure is applied at the same time; by which means, in squeezing out the air, the sides of the cells are brought closer together, and the wood becomes more dense. A remarkable instance of this has been related by Captain Scoresby, in his Account of his Voyages to the Whale Fishery in the Arctic Regions: a whale, on being harpooned, ran out all the line in the boat, and as the end of the rope was made fast, the boat was dragged by the fish under water, to the depth, it is supposed, of several thousand feet; the men having just had time to make their escape by leaping on a piece of ice. When the whale returned to the surface to breathe, it was killed; but, in place of floating, it began to sink, as soon as it was dead, in consequence of the weight of the boat, which was still attached to it by the line of the first harpoon remaining in its flesh. The sunken boat was raised with great difficulty; for so heavy was it, that, although before the accident it would have been buoyant when full of water, it now required a boat at each end to keep it from sinking. When they got it into the ship, the oaken planks were, Captain Scoresby says, "as completely soaked in every pore, as if they had lain at the bottom of the sea since the flood." A piece of light firwood, about fifteen inches square, that had gone down with the boat, when thrown into the water again sank like a stone.

It may be said, however, that, granting this transportation of trees and plants by rivers,—granting their sinking to the bottom of the sea, and their alternation there in layers with beds of sand and clay,—still their conversion into coal has to be accounted for; a substance not only different in appearance but also in properties from the substance of trees and plants. Here the researches of chemical science have come to our aid; for the conversion of vegetable matter into coal has been proved, by the observations of Dr. M'Culloch on peat-bogs, and by a series of experiments in the laboratory, instituted by the same distinguished philosopher. Coal, freed from its adventitious earthy matter, which is merely mechanically mixed with it, is resolvable into the same ultimate elements as wood; and Dr. M'Culloch ascertained that the action of water on turf, or submerged wood, is sufficient to convert them into substances capable of yielding bitumen on distillation, and black and brittle like those varieties of coal called, by mineralogists, lignite and jet; and he is further of opinion that great pressure and long-continued action may have produced the other modifications. The coal so produced differs, however, very materially in appearance and properties as fuel from the coal of our mines; and the last link of the chain between a lump of Newcastle coal and a growing tree has yet to be found.

[In our next section we shall describe the geographical distribution of Coal in the Mineral Kingdom.]

THE ICELANDERS.—No. 2.

ICELAND, which was so well known to England and the other northern countries of Europe in the time of its literary supremacy and its wandering poets, in subsequent periods of history seems to have been gradually withdrawn from all observation. The popular accounts of the island were such as could be collected by Greenland whale-fishers, who now and then touched at it, and were copiously mingled with fable and the superstitions of uneducated seamen, on whom volcanic and other phenomena made an awful impression.

The late Sir Joseph Banks, in 1772, undertook a voyage to Iceland, accompanied by Doctors Solander, J. Lind, and Uno Von Troil. Dr. Von Troil, one of his companions, who was a learned Swede, son of the Archbishop of Upsal, after his return to Sweden, drew up in a simple form, and popular, unostentatious style, an account of all that the expedition had seen and learned in Iceland. There had been several accounts of the island before published; but this was the most correct and instructive. A subsequent narrative of a journey made in the summer of 1810, by Sir George Steuart Mackenzie and Dr. Holland, confirms the account of Von Troil as to the excellent moral qualities, and the high intellectual attainments of the poor Icelanders.

The whole of Iceland is a chain of volcanoes extinct, or, to a greater or less degree, in action; its soil is almost everywhere formed of decayed cinders, lava, and slags. Numerous springs of boiling hot water, in columns of great diameter, shoot high into the air, carrying large stones up with them, as do the flames from the crater of a volcano. Some of the many mountains, that cross the island in every direction, are always covered with snow and ice; and the valleys between these mountains are in most instances strewn with hard, black, naked lava, for the distance of miles. Avalanches, called by the Icelanders *snioflod* (snow-flood), are of frequent occurrence, and the mountains themselves not unfrequently crumble away and roll down into the plain, burying the cottages or the farms beneath. Earthquakes, moreover, are very common, and at times (as happened in 1755) so violent, that the houses of a whole district are seen overturned, and hills rent asunder. Dreadful hurricanes, being still more frequent, are as ruinous as earthquakes.

In some places there grow stunted birch, juniper bushes, and other underwood, but a tree is not to be seen on the whole surface of Iceland. Where the volcanic matter has been sufficiently decomposed or crusted with vegetable earth, both the plains and the mountains offer tolerable pasturage, and thus enable the islanders to keep large flocks of sheep, on which, and their fisheries, their support mainly, or it may be said entirely, depends. Fortunately no wild animals except rats and foxes breed on the island; but they are liable to the visits of huge Polar bears, that are floated to their shores on detached pieces of ice. If these animals effect a landing, they generally prove very destructive to the sheep. To prevent this the Icelanders are very vigilant. When fire-arms are scarce, they put out to sea in their little fishing-boats and attack the invaders with spears and fish-hooks. If killed and secured these bears are of no mean value to them, for they cure and eat their flesh, and make excellent winter cloaks or rugs of their skins. The waves of the ocean, by throwing on their coast quantities of drift-wood from America and other parts, also increase the resources of the poor Icelanders. They use it for fuel, and the small houses they inhabit are frequently built of this drift-wood. Their residences are, however, more generally made of blocks of lava, the interstices between which they carefully fill up with moss to keep out the cold. Their roofs are of turf, and the windows, instead of glass, are furnished with the thin membranes of sheep or lambs. In small fenced spots near these primitive abodes, they cultivate cabbage, parsley, spinach, turnips, potatoes, with some other roots and vegetables, and raise flax and hemp as materials for their own clothing. The luxury of a single fruit tree is unknown.

Within, the scene is more cheerful; for, while the little hut is almost buried beneath the snows of winter, and darkness and desolation cover the land, "the light of an oil-lamp illumines the page, from which the father reads to his family the lessons of knowledge, religion, and virtue." In these regular evening readings the master of the family always begins, and he is followed by the rest in their turn. Even during their daily in-door labours, while some are employed in making ropes of wool or horse-hair, some in preparing sheep-skins for fishing dresses, or in spinning, knitting, or weaving, one of the party generally reads aloud for the amusement and instruction of the whole. Most farm-houses have a little library, and they exchange books with each other. As these houses are scattered over a wild country, and far apart, the only opportunity they have of making these exchanges is when they meet at church; and at church a few always contrive to be present even in the most inclement weather. In many parishes there is also a small collection of books, the property of the church. This library is under the superintendence of the minister of the parish, who lends the books to any family of the district that may be desirous of increasing its means of instruction and amusement. The parish priest, acting occasionally in aid of the parents, is also the schoolmaster of the district, and keeps a register of the intellectual and moral improvement of the younger part of his flock. He himself is exempted from few of their laborious occupations, enjoys few additional privileges or comforts, and only keeps his place in a society, where all are anxious for instruction, by the superiority of his intellectual attainments. In their ecclesiastical code, a singular law, but admirable in design, gives to the clergy the power of preventing any marriage where the female is unable to read; and thus, in the instruction of the mother, on whom so much depends, this law provides for the education of the offspring. Sir George S. Mackenzie and Dr. Holland remarked that, except at the great fishing stations, it was rare indeed to find any Icelander, whatever might be his condition, who could not both read and write. But they have much higher accomplishments. Latin still forms part of the education of the people, as well as of the clergy—the Icelanders still write it, both in poetry and in prose; and it is a common thing for the stranger, while traversing their country, to find his peasant guide addressing him in good Latin, and his host at night, drawn, perhaps, from the humble labours of the smithy, conversing with him in the language of Virgil and Cicero, with great fluency and elegance. Not a few of these poor islanders are also well acquainted with the language and literature of ancient Greece. Among modern tongues they have cultivated the Danish, the German, and the English. In 1810 they had translations from Addison, Richardson, Young, Pope, and Milton.

The general attainments of this people are the more surprising, as owing to the distance from place to place, or even from house to house, to the frequent interruption of all communication by snow-storms and inclement weather, to the necessity in which nearly all are of almost constantly working in some way or other for their support, and to other circumstances, the Icelanders cannot follow any extended scheme of public education, but depend entirely for the acquisition and transmission of knowledge on their own private resources and domestic habits. In the year 1810 there was only one public school in the whole island.

The fine arts in Iceland have not been cultivated with the same success as literature. Although by the old laws of the country, music as well as poetry was expressly made a branch of common education, their music has been stationary at a very simple, if not a barbarous point. Nor have painting and sculpture made much more progress. Yet here it is well to observe that the celebrated modern sculptor, Thorvaldson, who so long resided at Rome, where he was second only to the great Canova, was the son of an Icelander.

In describing their readings and fondness for books, we have described the principal amusement of these people. Another of their pastimes is to meet together at their leisure hours, and to recount to one another the history of former times,—"so that," says Von Troil, "to this day you do not meet with an Icelander who is not well acquainted with the history of his own country." They also recite verses at their festive meetings, where there is rarely anything drunk save an unfermented preparation of milk with water; and sometimes a male and a female sing a poem in dialogue, in a slow, cadenced sort of recitative. They are great chess-players, and familiar with several ingenious games at cards, but they never play for money.

The ordinary food of these civilized peasants is very poor. Bread is often a stranger to their mouths for months, and that which they eat consists of sour biscuits, and hard, dry rye-bread, imported from Copenhagen. Fish is the most important article of consumption among them, and they eat the flesh both of sharks and whales. The dangers to which they are exposed while fishing in their stormy seas are great, and though they meet them like brave men, they are fully sensible of their existence. Whenever they put off from shore, they reverentially take off their caps, sing a short hymn in concert, and in a prayer recommend themselves to the merciful protection of the Almighty.

The dress of the Icelanders is neither smart nor ornamental, but almost invariably neat, clean, and well suited to their rigid climate. They have all (that great criterion of civilization) a supply of body linen, and every man wears a linen shirt of his own household manufacture.

In person the Icelanders are neither strong nor handsome: in their dispositions they are mild, reflective, and serious; they have no boisterous mirth, but a sober, subdued cheerfulness, which is better, and lasts much longer.

Hospitality, to the utmost extent of their means, is one of their many virtues. No people in the world are more attached to their native land, which, cold, stormy, and desolate as it is, they prefer to every other country. The present population of Iceland is stated as being about fifty thousand.

Bread, in some parts of Sweden.—It was impossible not to be struck with a specimen that was pointed out to our notice of the food of the peasantry, during a hard season, in the more remote districts. It was a cake from Dalecarlia, made of the bark of trees: of this provender the birch is the most common in use, while that of the pine is held luxurious and dainty fare; but to procure a little rye-flour, and add it to this wretched mixture, is a happiness that falls to the lot of few. The inner bark or parenchyma is applied to this purpose; it is simply macerated in water, ground up, and formed into cakes of the consistence of a wafer; their taste is slightly bitter, but seemed, I thought, by no means less palatable than the coarse leaven bread of rye, made with old sour yest, which generally may be called the "staff of life" even throughout the more fertile parts of Sweden. The use of so poor a diet in a climate that requires the most nutritious regimen is attended with its inconveniences: the rustic peasants in general, though large and bony, are of a spare habit, and on the smallest alteration or improvement of their food are subjected to severe attacks of plethora. Many of these poor creatures do not survive their first visit to Stockholm, where, when they are ill of a surfeit, their disease is usually called the Dalecarlian malady, from its prevalence among that people: this complaint, indeed, seizes upon them in so great numbers, as to give an idea to the vulgar of its being contagious, and one frequently hears, as the phrase is, that it is "going about." — *James's Travels in Sweden and Russia, &c., during the Years* 1813 *and* 1814. The same traveller afterwards gives a remarkable instance that occurred in 1788, when a regiment of provincial militia was called to do duty at the capital. Among the rations allowed to these men were wheaten bread and a little meat,—a violent malady and considerable mortality in the regiment were the consequences of this sudden change of diet, nor did the men recover until an inferior bread, adulterated to the requisite degree of meagreness and indigestibility was served out to them, and the more nutritious parts of their food withdrawn.

BRIGHTON CHAIN PIER.

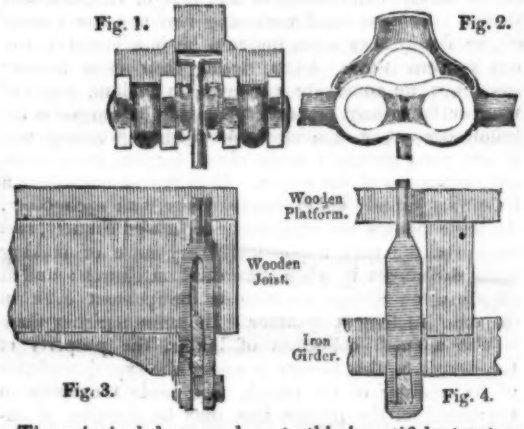
In our account of 'The Great North Road,' we gave views of several suspension bridges: the same principle, viz., of suspending a roadway by rods, from chains hanging in a curve from one tower to another, has been employed in several cases, by Captain Brown, for constructing piers, or jetties, extending many hundred feet into the sea, and forming thereby most commodious quays, and landing-places at all times of the tide, and in situations where no vessel of a moderate size could approach the shore.

The town of Brighton has enjoyed the benefit of this useful contrivance, where, as many of our readers know, a beautiful chain pier has withstood the buffeting of storms for nine or ten years past. On the 15th October last, however, for the first time it suffered severely from a storm; and from the total absence of all eye-witnesses to the catastrophe, there appears to be great difficulty in determining how it was actually produced.

It appears that at half-past seven in the evening a tremendous gale came on from the west, attended with heavy rain and lightning; a very short time previously, the pier-master had returned from the pier, when it was in every respect in its usual state. The night was dark, so that a person on the cliff could not easily discern the progress of destruction; but as it was low water, so low, that it is said there was no water under some parts of the pier which suffered most, it is evident that the water could not cause the destruction. Some persons have supposed it must therefore be the effect of lightning; there was lightning on that evening, but all concur in stating that it was not accompanied by thunder, consequently it must have been too far off to have struck the pier. Neither is there any probability that lightning could injure the pier: there is not a rod used in its construction which is not considerably thicker than the common iron conductors used for the protection of buildings; the rods, therefore, could not be melted, and indeed there is not the slightest trace of melting in any part of them; and as every rod is in close contact, they form one uninterrupted conductor, both ends of which terminate a considerable distance underground. The damage, then, is to be attributed to the wind; and it is interesting to inquire in what way the wind produced so great an effect, the pier having previously withstood much more tremendous gales.

The pier consists of a platform, about thirteen feet wide, and about a thousand feet long, suspended from eight chains, passing over four towers, the chains being at one end fixed in the cliff, and at the other end fixed in masonry sunk in the sea. The eight chains are arranged in pairs, side by side, there being two pair on each side the platform, one pair being hung about twelve inches above the other. The parts between the towers are called bridges; and to distinguish them we may call them the first, second, third, and fourth bridges from the cliff. The towers are made of cast iron, and each rest upon twenty piles, driven with more than the usual force into a bed of chalk; the last tower and the extension of the platform, forming the pier head, rest upon 100 piles, well bound together, and further stiffened by piles driven diagonally.

The four main chains are made of wrought iron, two inches in diameter, in links ten feet long; and the platform is suspended from the main chains by suspension-rods about one inch in diameter; the upper ends of the suspension rods are inserted in hollow caps, resting on the joints of the main chains. Figs. 1, 2, 3, and 4 show the construction of these caps, and of the suspension-rods and platform.



The principal damage done to this beautiful structure was in the second and third bridges; the platforms of both were more or less destroyed, most of the suspension-rods snapped, and the main chains were left hanging almost independent of the platform, one of the upper pair of chains being separated from its companion and twisted round the pair below it. In the first and fourth bridges there was little other effect produced than what might result from the sinking of the main chains in consequence of the counterbalancing weight of the second and third bridges being removed; thus these bridges had swagged down, and parts of the hand-railing were broken and some of the suspension-rods were bent, but almost all the caps of the suspension-rods appear to have been moved; some of the towers are also thrown out of the perpendicular.

Let us now consider the manner in which the wind most probably produced its destruction. Some have

supposed that a violent gust of wind had lifted up the third bridge, and that when it fell again it snapped the suspension-rods. Now it does not appear likely that any gust of wind could lift so heavy a body; while a moderate storm, if we may use the expression, could, under certain circumstances, easily cause such a structure to swing to and fro.

The writer of this article once tried, by mere strength of arm, to put in motion the main chains of a suspension bridge, 400 feet in length between the towers. At the first few thrusts no sensible motion was produced; but as care was taken to time the thrust, just as is done in the common amusement of swinging, the whole bridge was soon set in motion.

On the night of the accident, the wind was due west,—and consequently it fell directly at right angles on the pier, the most favourable direction for producing vibration sideways. The first gust of wind would produce a very slight vibration; but whether the vibration were little or great, it would follow the laws of the pendulum, and take, we will suppose, three seconds to make one vibration, namely, three seconds to attain the end of its motion east, and three seconds to return to the end of its motion west, making together six seconds. Now, every gust, which did not take place in twelve, eighteen, or twenty-four seconds, or some other multiple of the time of vibration, would tend to stop the vibration; which has probably been the case in all previous storms, the wind being generally so irregular as generally, perhaps, in the case of vibration, to counteract its own violence. Thus, it is not the weakest trees of the forest which are destroyed by the storm, but probably such whose times of vibration happen to correspond with the times of the gusts.

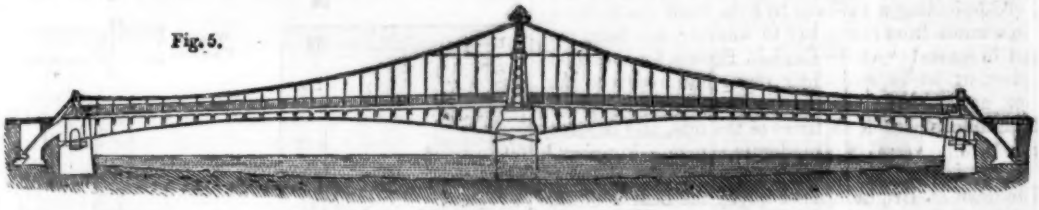
Now, we have only to suppose that, on that particular night, the gusts of wind happened to recur in intervals corresponding with the time of vibration of the main chains, *i. e.*, in eighteen, twenty-four, or thirty seconds, or in some other multiple of six seconds—the time we have to suppose the bridge would take to vibrate from the west to the east and back again to the west; and then, although those gusts might be far less violent than many a storm before, yet, occurring at these particular times, they might produce so violent a motion, as to wrench off the heads or break some of the centre suspension-rods, where the vibration would of course be greatest: when the centre rods gave way, the weight of the centre part of the platform would be thrown on the adjoining suspension-rods, which would, of course, more readily give way: as soon as the suspension-rods had suddenly set the main chains at liberty, the weight of the adjoining bridge would suddenly draw up, or, as the result has showed, fling up the chains of the broken bridge, and thus account for the entangling of one chain with the other. The separation of the one chain in the upper pair from its fellow was very possible, as soon as the caps of the suspension-rods were dislodged, the pair not being held together, except by these caps.

A practical illustration of the effect of repeated impulses, at stated intervals, occurred some time since at the Broughton suspension bridge, near Manchester, which had stood the ordinary traffic well; but one day a regiment of soldiers was passing over the bridge—the first and second companies walked over with irregular step and passed safely; as the third company were passing over, a fifer struck up a favourite march, and the men immediately dropped into the regular military step, and presently the bridge gave way and let them all into the river,—fortunately every man got out without any material injury.

In this case the bridge might be said to have broken with a weight which it had previously borne, just as the chain pier is said to have given way to a force which it had previously borne; but as, in the former case, the damage was done by the stated impulses of the men's feet, so, in the latter case, the damage was in all probability done by the stated impulses of the wind.

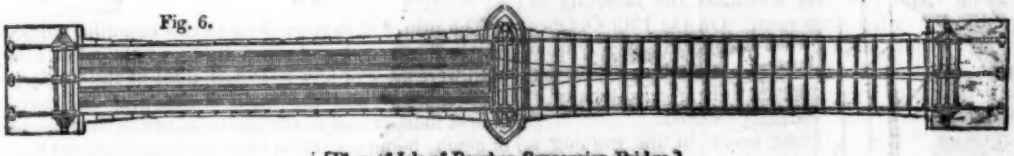
If the foregoing suggestions be correct, namely, that the disaster was produced by the swinging of the chains and platform to and fro, it will show the importance of a contrivance added, by Mr. Brunel, to two suspension-bridges, constructed by him for the Isle of Bourbon about ten years since, and that similar precautions may be useful even in this country. An accurate description of one of these bridges is given by Dupin in his 'Commercial Power of Great Britain.' Dupin observes, that "it was necessary that the bridge should be sufficiently powerful to resist storms which tear up trees by the roots and swallow up vessels by gusts of wind, which act with extraordinary force not only in a horizontal but in a vertical direction, and, by turns, upwards and downwards."

Fig. 5.



[Isle of Bourbon Suspension Bridge.]

Fig. 6.



[Plan of Isle of Bourbon Suspension Bridge.]

Mr. Brunel obtained a proper resistance (see Figs. 5 and 6) by employing a double system of chains: first, the usual upper chain; secondly, lower and inverted chains, united to the road-way of the bridge by vertical rods, which are, properly speaking, the suspending-rods of the inverted chains. In order to give firmness to the road of the bridge, horizontal with the stream, the lower chains, instead of being on a parallel plane with the upper ones, diverge from them near the points of support, as is clearly shown in fig. 6

Fig. 7.

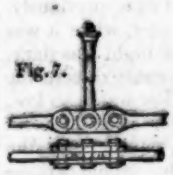
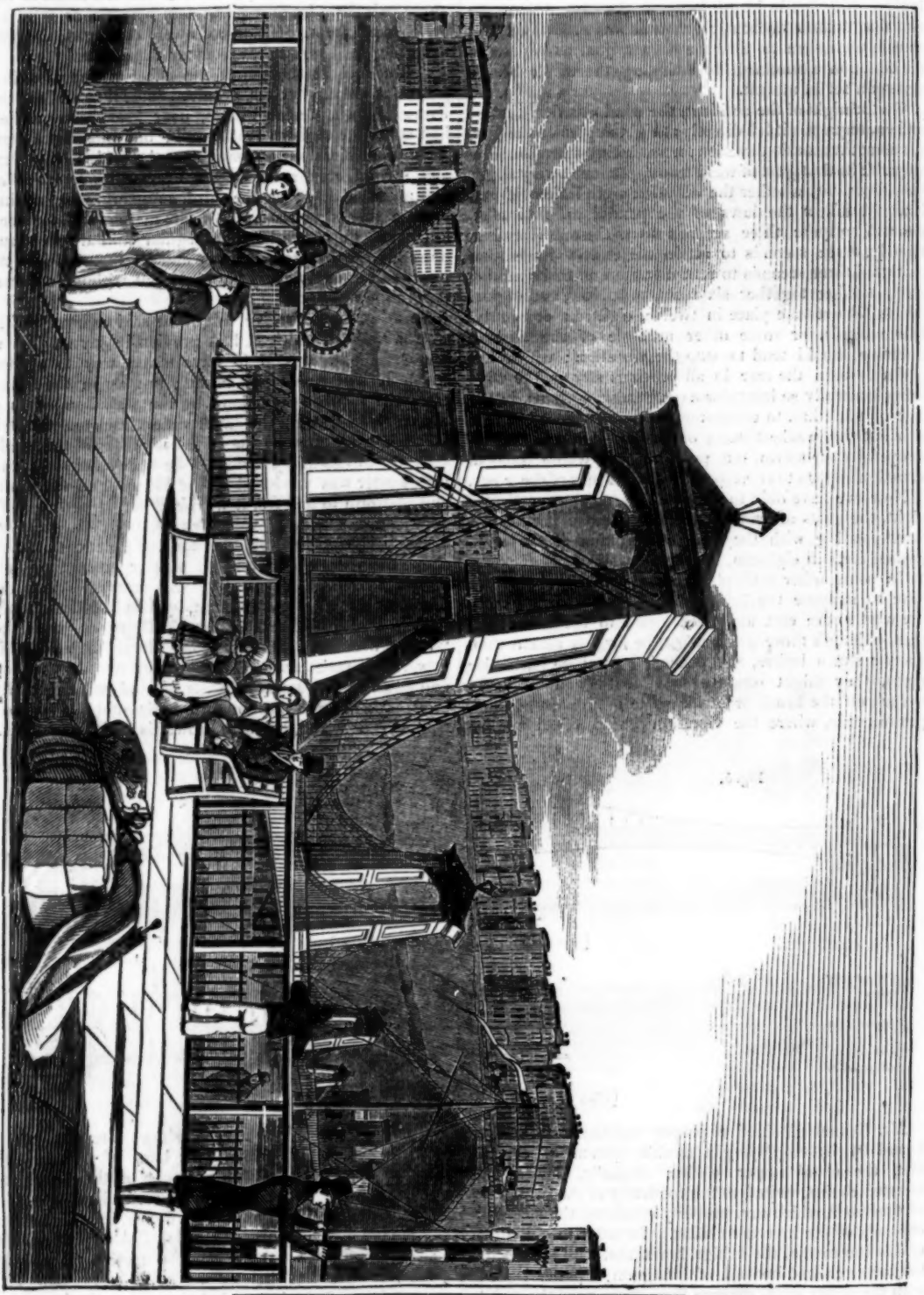


Fig. 7 shows the manner in which two bars of the inverted chains and one of the lower suspension-rods are joined together. From this figure it will be seen that two flat links, pierced with three holes to receive three bolts, belong respectively to two contiguous bars of the inverted chain, and to the lower rod between them. The upper part of this suspending-rod

goes through the corresponding beam close to one of the upper rods, and is fastened by a screw on its head. The last bar of the inverted chain goes through the whole thickness of the masonry of the central pier of the bridge, and, on coming out, is set in a large plate of cast iron; thus a great part of the pier has to support the great strain or tensions which the inverted chains must experience during storms and when the wind blows upwards. The same system is used to attach the other extremities of the inverted chain to the abutments. These inverted or, as they may be called, stay-chains have been found hitherto to answer the purpose.

Since the above observations were written, a public subscription has been made for repairing the Brighton Chain Pier; and it has also been stated, in one of the public journals, that it is intended to add stay-chains: these, there is no doubt, will render it perfectly secure.



[Brighton Pier.]

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